Some Temperature Refraction Coefficients of Optical Glass.

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(Communicated by Prof. S. P. Thompson, F.R.S. Received February 6,—
Revised March 18, 1915.)

In a previous paper,* the refractive indices of a number of typical samples of glass were given, but the temperature coefficients—although measured—were omitted at the time. The late Sir David Gill having shortly before his death expressed a wish that they should be published, the following paper complies with this desire.

In addition a table is given of the refractive indices of glass meltings since measured, together with an account of an attempt to determine, if only approximately, the influence of atmospheric pressure (barometer changes) on measurements of refractive index generally.

The special methods employed to obtain the indices and to estimate the probable error, as well as the instruments used, are the same,† except in the case of Schott's Fluor Crown. In this case, the melting being a small one, only one prism was cut, and the limit of uniformity in its production has, therefore, not been ascertained; it may, however, be noted in this connection that its temperature refraction coefficient is a minus quantity as with quartz and fluorite. In no other glass melting has this been found by the author, all others having the plus sign, that is, the refractive index in air rises with the temperature.

In order to determine the change in the apparent refractive index due to the varying barometric pressure, a number of experiments were made in which on different days the refractive indices were compared, the temperature so far as possible being the same. It was pointed out to me by Prof. Schuster that these experiments indicated that far the greatest part of the change was due to alteration of the refraction in air.

Tables of the temperature refraction coefficients of all the glasses and of the refractive indices of those meltings not previously given follow.

It should be noted that the numbers indicating the "probable error" include the actual differences in the refractive indices of different specimens of glass from the same melting and the accidental errors of the determination of the index of each. The former, as pointed out in my previous paper, is much the larger of the two. The refractive indices are referred to air. The

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* 'Roy. Soc. Proc.,' vol. 87, p. 189 (1912).

† 'Roy. Soc. Proc.,' vol. 70, p. 329 (1902); and 'Monthly Notices R.A.S.,' vol. 69, p. 118 (1908).

Designation …	Fluor Crown.	Borosilicate Crown.	Crown of lowest μ_D.	Silicate Crown.	Barium Silicate Crown.	Dense Flint.	Telescope Flint.
	S. 8897.	S. 6107.	S. 3113.	S. 7181.	S. 7714.	S. 5403	S. 8204
$F-C = \delta\mu$………	0·006896(5)	0·008517	0·008586	0·008749	0·009086	0·016582	0·010242
Probable error …	Undetermined	±0·000014	±0·000020	±0·000079	±0·000083	±0·000084	±0·000048
$\nu = (\mu-1)/d\mu$ …	70·775	62·120	59·467	60·246	59·516	36·966	51·594
Wave-lengths.							
A′. 7682. K_α ……	1·48349$\bar{6}$	1·52355$\bar{6}$	1·50502$\bar{5}$	1·52143$\bar{2}$	1·534892	1·602868	(1·52185$\bar{8}$)
B′. 7066. He……	1·484749	1·525075	1·506545	1·522924	1·536492	1·605543	1·52363$\bar{5}$
6708. Li ……	1·485624	1·526076	1·50755$\bar{9}$	1·52398$\bar{6}$	1·537580	1·607396	(1·524834)
C. 6763. H_α ……	1·486012	1·526533	1·50802$\bar{8}$	1·52446$\bar{5}$	1·53806$\bar{1}$	1·60824$\bar{0}$	(1·525410)
D. 5893. Na ……	1·488102	1·52907$\bar{7}$	1·510560	1·52707$\bar{8}$	1·54073$\bar{6}$	1·612974	1·52842$\bar{5}$
Λ. 5607. Pb ……	1·48918$\bar{7}$	1·53040$\bar{6}$	1·511928	1·52842$\bar{9}$	1·542186	1·615558	1·53004$\bar{1}$
5461. $H_{\gamma 1}$ …	1·48982$\bar{3}$	1·531182	1·512703	1·52921$\bar{2}$	1·543001	1·617055	(1·530959)
E. 5270. Fe ……	1·49070$\bar{2}$	1·532271	1·513825	1·530359	1·54415$\bar{4}$	1·619212	1·53227$\bar{8}$
F. 4861. H_β……	1·492909	1·535050	1·516613	1·53321$\bar{4}$	1·547146	1·62482$\bar{2}$	(1·535652)
Φ. 4678. Cd_6 …	1·494114	1·536570	1·518137	1·534801	1·548749	1·627918	1·53748$\bar{6}$
4415. Cd_7 …	1·49609$\bar{1}$	1·539041	1·52069$\bar{9}$	1·537401	1·55138$\bar{9}$	1·633193	1·54055$\bar{0}$
G′. 4341. H_γ……	1·49673$\bar{1}$	1·539820	1·52149$\bar{1}$	1·538204	1·552261	1·634899	(1·541495)
4046. $H_{\gamma 2}$ …	1·49960$\bar{5}$	1·543462	1·525211	1·54196$\bar{4}$	1·556187	1·64286$\bar{6}$	1·546024

Note.—Indices in brackets have been interpolated.

temperature coefficients indicate the changes of the index due to a rise of 1° C., the normal temperature being 15° C. In order to reduce these indices to vacuo, corrections have to be applied which are easily calculated. Approximately the correction is minus 10 in the last decimal place, so that "Silicate Crown (S. 7181)" would have a zero coefficient for the refractive index referred to vacuo.

Table of Temperature Refraction Coefficients ($\lambda = 5270$) for 1° C.

Type.			
0,6781	Fluor Crown	(S. 8897)	−0·0000035*
0,2188	Borosilicate Crown	(S. 6115)	0·0000021
411	,, ,,	(C. 557)	0·000001$\bar{9}$
0,144	,, ,,	(S. 5077)	0·000003$\bar{0}$
0,3832	,, ,,	(S. 5028)	0·0000102
0,144	,, ,,	(S. 6141)	0·000001$\bar{4}$
3790	,, ,,	(M. 6132)	0·000004$\bar{0}$
0,3390	,, ,,	(S. 3581)	0·000002$\bar{0}$
0,3512	,, ,,	(S. 6107)	0·000001$\bar{6}$
0,3453	,, ,,	(S. 4812)	0·000001$\bar{5}$
0,2118	Crown of lowest μ_D	(S. 3113)	0·0000036
0,138	Silicate Crown	(S. 7181)	0·0000010
0,3655	Telescope Crown	(S. 3418)	0·000000$\bar{7}$
0,3551	Zinco-silicate Crown	(S. 4705)	0·000003$\bar{3}$
0,227	Barium Silicate Crown	(S. 7714)	0·0000049
0,211	Densest Barium Silicate Crown	(S. 4962)	0·000001$\bar{2}$
4087	Baryta Light Flint	(M. 4087)	0·000003$\bar{8}$
0,3439	Telescope Light Flint	(S. 8204)	0·000004$\bar{7}$
0,826	Baryta Light Flint	(S. 4677)	0·0000012
0,3439	Telescope Light Flint	(S. 4805)	0·0000053
0,2071	Dense Barium Crown	(S. 4674)	0·000000$\bar{4}$
4078	Heavy Barium Crown	(M. 5201)	0·000003$\bar{8}$
0,3439	Telescope Flint	(S. 5992)	0·0000040
0,3961	Densest Baryta Crown	(S. 4704)	0·000005$\bar{8}$
0,3338	Borosilicate Flint	(S. 3338)	0·000004$\bar{5}$
0,527	Baryta Light Flint	(S. 3187)	0·0000018
0,364	Borosilicate Flint	(S. 3193)	0·0000105
0,578	Baryta Light Flint	(S. 5042)	0·0000035
0,364	Borosilicate Flint	(S. 0364)	0·0000041
0,154	Ordinary Light Flint	(S. 3831)	0·0000033
3885	Light Flint	(M. 6812)	0·000003$\bar{9}$
0,748	Baryta Light Flint	(M. 4870)	0·0000046
384	Dense Flint	(C. 629)	0·0000070
0,118	,, ,,	(S. 5403)	0·000002$\bar{5}$

* The temperature refraction coefficients for—

Quartz (ordinary ray) = −0·000005$\bar{2}$
Fluorite = −0·0000102